sequent report of this discussion in your Journal these views were suppressed. The abstract of the rejected paper was printed in the annual report of the British Association, just issued, among the Section B papers, from the officers of which section I had received uniform courtesy and consideration throughout the transaction.

Now such a joint resolution as I have mentioned ought to have precluded any referee from rejecting a paper which had already been approved, and I have to suggest that a by-law be framed to render an occurrence of this kind impossible in the future.

William Ackroyd.

Striped Hawk-moths in Sligo.

There has been a letter or two in recent numbers of Nature on the finding of rare moths in England. It may be of interest to the writers to know that in the middle of last September there was caught in the town of Sligo a specimen of the striped hawk-moth. It was captured in the printing office of the *Sligo Independent*, its great bulk first attracting attention and then its beautiful markings. I know but very little about insects, the honey bee excepted, but I carefully compared the living object with a description and coloured plate in a work on Lepidoptera, and have no doubt but that it was the very thing your correspondents are making so much ado about. It is now preserved in a little collection of Mr. Irvine (Ratcliffe Street), but the gorgeous colouring has all gone, and the striping is barely traceable. I have been told that another exactly similar moth was found last year a few miles from Sligo along the sea coast.

I never noticed one of these insects before, but if it be such a rarity in the British Isles as your correspondents seem to hold, it is easy enough to account for its presence in the present instance. Sligo is a sea-port town, and in August last a cargo of timber from, I was told, South America was discharged. Most likely the eggs came over in the timber and were here hatched out.

Joseph Meehan.

Creevelea, Drumkeeran, co. Leitrim.

THE SIMPLON TUNNEL.

As the Simplon Tunnel is rapidly approaching completion, natural curiosity is aroused as to the extent to which the accuracy of the alignment has been attained. This is a riddle which can only be answered when the last metre of rock has been removed and the two headings unite.

It was hoped that this international meeting of Switzerland and Italy, under Mont Leone, would take place in October, but in consequence of unexpected difficulties which occurred early in September, it is probable that the actual junction will not occur so soon.

The setting out of the centre line of the tunnel is done every month by the company and contractors, but, in addition to this, the work is checked several times in the year by the Government engineers. On these occasions the work in the tunnel is entirely suspended, so as to ensure that the atmosphere for the entire length shall be bright and clear. A small slit of light is thrown into the tunnel by means of a powerful lamp, and by the aid of theodolites this is taken right up to the working face. It is anticipated that when the actual meeting occurs the error in level will be nil, and that the error in direction will be under eighteen inches.

As our readers know already, the length of the tunnel will be 12¼ miles, all of which has been penetrated with the exception of a short distance of about 260 yards near the middle. The work consists of two single line tunnels 50 feet apart, axis to axis, and the object of having two tunnels in place of one has been fully justified by later experience, and for the following reasons. The ventilation is much more efficient, one tunnel being used as an "intake" for fresh air, which is blown in by powerful high-speed fans working with a water-gauge of nearly 9 inches, the other being the outlet; in case of derailment of a train occurring it cannot possibly run into a train in the opposite direction; when repairs are required one tunnel can be closed for a time, the traffic being conducted in the other; and finally, which is most important, the crushing weight of the material overhead is much more easily dealt with than it would be in a double line tunnel. When it is remembered that the overlying rocks extend to a height of 7005 feet, and that the workmen are at the enormous distance of nearly 1½ miles below the surface, or 50 per cent. more than man has ever been heretofore, it will be realised that not only is the pressure enormous, but the heat is also great; in fact, the pressure which has been encountered is so great that in one place the arching, consisting of granite blocks, is 2 metres in thickness. The tunnel is arched throughout, as it was deemed advisable that no risk should be incurred of even a

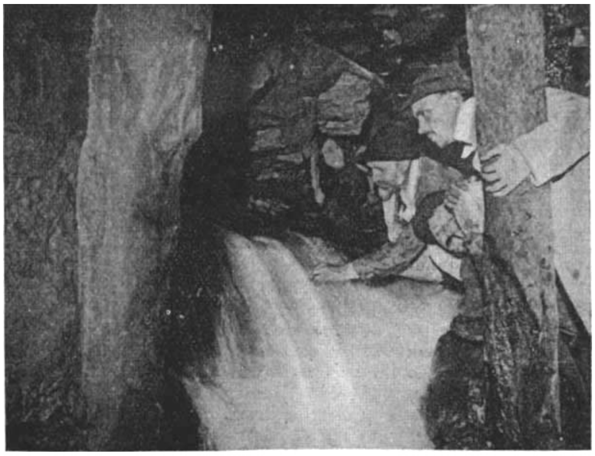

Fig. 1.—The Great Spring, 12,000 gallons per minute.

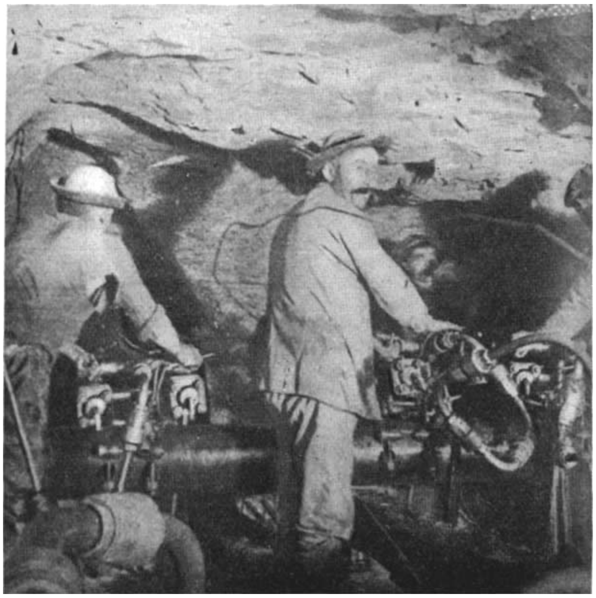

Fig. 2.—The Brandt drill at work at the "face." Daily progress 18 feet. Size of heading 10 feet × 6 feet.

small fragment of rock falling on to the permanent way.

In order that the present condition of the work may be better understood, a longitudinal section along the line of the tunnel is given, drawn to a small scale; and, with a view to illustrate the facts better, the gradient is very considerably exaggerated.

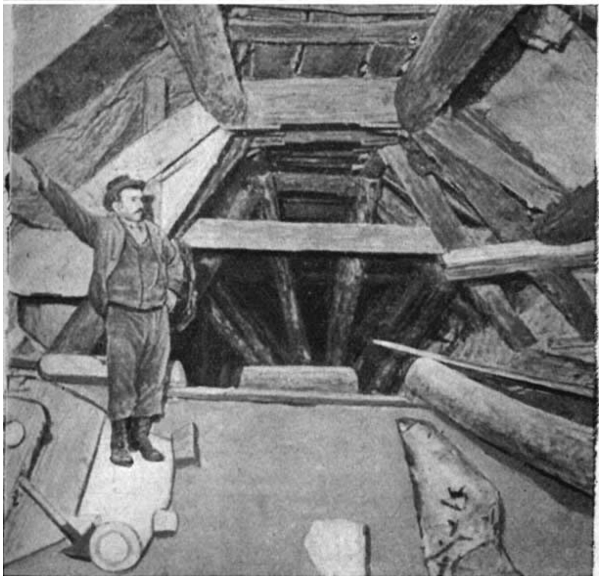

FIG. 3.—The timbering of the tunnel—six miles from the entrance.

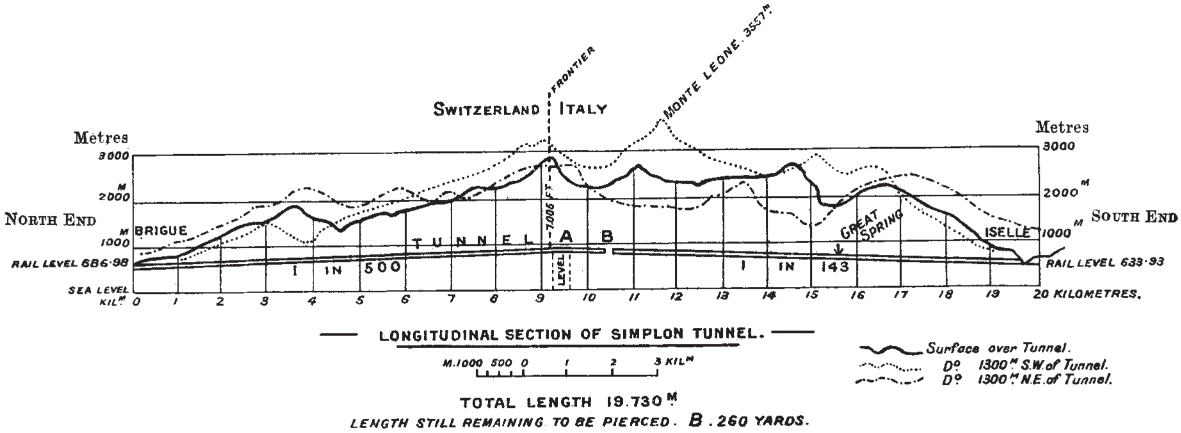

FIG. 4.—Longitudinal section of Simplon Tunnel.

It will be noticed that the gradient rises from each end of the tunnel towards the middle, the object of which has been to provide efficient drainage from the face, and it is an instance of the prudence which has been exemplified throughout the entire work that this system was adopted from the commencement. In driving a heading forward under a mountain, it is a matter of very common occurrence that springs of water are encountered; consequently, on the ascending gradient, the water flows away by gravity from the workmen; but should the work be carried out on a descending gradient, then the water accumulates where the men are working, not only causing them inconvenience and delay, but requiring to be pumped out over the highest point of the rails. In order to prevent delay, this was done for some considerable distance; but in consequence of a hot spring being encountered at the " face " on the Swiss side it was deemed necessary to withdraw the workmen, and the tunnel between points A and B has become filled with hot water.

At each end of the tunnel—Brigue at the north portal, and Iselle at the south or Italian entrance—a large and well equipped installation is provided for carrying on the works, and each of these is provided with machinery of sufficient capacity and power to serve for half the distance, that is, to the summit of the tunnel at A.

The work of actual perforation at Brigue and Iselle began in August, 1898, by hand, and by Brandt drill in December, 1898. When, however, the advance from the Italian entrance had reached a point between 15 and 16 kilometres, the great spring of 12,000 gallons per minute was encountered. This caused a delay of several months, thus throwing back the progress very considerably. In the meantime, the advance from Brigue proceeded rapidly, the summit A being reached in the month of December, 1903. Then arose the question, as already explained, in order to save time, of driving the tunnel downhill in order to meet the workmen coming up from Italy.

Meanwhile, the work on the Italian side has been pushed forward until the distance remaining to be pierced, as already mentioned, is only some 260 yards; but a serious difficulty has arisen, for again a hot spring has been encountered, and the temperature of the rock in the advance gallery is 108° F.

The system adopted for dealing with hot springs is very ingenious—and at the same time very simple. It was at first proposed to conduct the hot water out of the tunnel through pipes, but the simpler and more efficient method, which was adopted, is to play a jet of cold water into the fissure from which the hot water is escaping, and thus to cool it down to such a degree that the workmen are not seriously incommoded; they are then able to continue the drilling and blasting.

A channel or canal is being excavated at one side of the tunnel to carry the hot water from the spring to the outside, and this will be covered over with non-conducting material to prevent the heat rising into the tunnel.

The question arises from whence this great heat comes, for although observations made in various wells and borings in all parts of the world give an approximate figure of 1° F. rise in temperature for each 70 feet of vertical depth, this is insufficient to account for what has been encountered, and one is driven to the conclusion that some portion of the thermal result is due to the internal heat of the earth arising from volcanic agency.

The energy and skill of those in control, amongst whom are Colonel Locher, Herrs Brandau, Pressel, Kager, Sulzer, and many others, are surmounting these difficulties, and it is anticipated that without any very great delay the junction of the headings will be effected.

Certainly no tunnelling operations in any part of the world have been exposed to such vicissitudes and difficulties, and when the arching of the tunnel is fully completed little will be left to show how hardly earned has been the victory over physical obstructions.

It is expected that within three months of the piercement trains will be running, and the railway will prove to be a most important link in the line of communication between Rome, Genoa, and Milan with Lausanne, Berne, and mid-Europe. FRANCIS FOX.

WATER-DROPPERS AND RADIUM COLLECTORS.

IT is more than forty years since Lord Kelvin commenced a new era in measurements of atmospheric electric potential by devising the water-dropper. Though marking a great advance, and simple in its construction, the water-dropper has not increased the happiness of those responsible for the conduct of self-recording meteorological instruments. It has weaknesses which it takes some time to discover, and which, when undetected, may lead to serious error. Some of the earlier forms had their water reservoirs so constructed that the pressure under which the jet issued varied considerably with the time since the reservoir was filled. Punctuality in filling the reservoir had in this case the disadvantage of accentuating a subsidiary diurnal variation not due to nature. The misdirected attention of spiders, variations of moisture, and other meteorological conditions, produce changes of insulation in the water tank; choking of the jet occasionally happens through impurities in the water, and in severe winters there may be complete stoppage through freezing of the jet. As this major catastrophe usually occurs at night, it generally entails a considerable loss of trace.

The idea of replacing the water jet by some radio-active substance presented itself pretty soon after the announcement of Becquerel's discoveries. The report of the International Meteorological Committee, which met at Southport in 1903, contains a note by Prof. Paulsen on his early use of a radio-active powder. This was spread on filter paper resting on a disc of copper, a thin covering plate of aluminium serving as a protection against rain. In this form the apparatus was used in Iceland in 1899–1900. M. La Cour modified this form by mixing the powder with caoutchouc into a paste, which was spread on a disc of copper, while a thin copper grating was pressed down on the top of the paste before it was quite dry. This form was used with satisfactory results in Finland in 1900–1. After wetting by rain, however, its efficiency was temporarily lessened. The same report also describes an instrument which M. Moureaux had had in use for some time at Parc St. Maur Observatory, Paris. It employs as collector chloride of radium in a shallow copper vessel, over which is soldered a plate of aluminium 0·1 mm. thick to keep out rain. Chloride possessing 5000 times the activity of uranium was not sensitive enough, but chloride with 30,000 times the activity of uranium gave good results. M. Moureaux so arranged matters that he could at pleasure record the electric potential, practically at a fixed point, either by the radium collector or a water jet. In this way he obtained an electrogram, successive portions of which were obtained in immediate sequence by the two collectors. Unless the times of the change had been indicated, one could not have told by inspection of the curve—which is reproduced in the report—which collector was being used. When M. Moureaux's note was written the radium had been in use for several months with satisfactory results. A foot-note, however, of later date, mentions that some months later the radium was found to have produced a number of minute holes in the aluminium, and that it was intended to dispense with the aluminium and protect the radium against rain by coatings of varnish. It was further hoped that this would admit of the use of cheaper chloride of less radio-activity.

The employment of radium is thus hardly out of the experimental stage, and any one adopting it at present would be well advised to check the action from time to time by recourse to a water jet. It would also be desirable to make sure before final adoption that the radium does not itself modify the potential which it is desired to record, more especially in calm weather. Whatever the final outcome may be, it is at least satisfactory that M. Moureaux's experiments showed agreement between the water jet and the radium collector when both were upon their good behaviour.

C. CHREE.

NOTES.

THE friends of Prof. G. Carey Foster, F.R.S., are taking the occasion of his recent retirement from the principalship of University College, London, as an opportunity of showing their appreciation of him by promoting a fund with the object of having his portrait painted for presentation to the council of the college, and a replica for presentation to Mrs. Foster. The president of the movement is the Right Hon. Lord Reay, G.C.S.I., and the vice-presidents are Sir Norman Lockyer, K.C.B., Sir Oliver Lodge, and Sir Arthur Rücker. Further information with regard to the scheme may be obtained from the secretaries of the fund, University College, Gower Street, W.C.

THE death is announced at Hamburg, on September 27, of Dr. H. Kortum, professor of mathematics at the technical college at Bonn.

THE Naples Academy of Physical and Mathematical Sciences offers prizes of 500 francs to the authors of the best papers in Latin, French, or Italian on the two following subjects: the processes of formation of urea in the animal organism, and the evolution of the ovaric ovum in the Selacii. The essays are to be sent in anonymously, bearing a motto, on or before June 30, 1905. The Padua Society of Encouragement offers, to Italian subjects only, two prizes of 5000 francs for an essay on the present state of the problem of electric traction on railways, and for a new method of diagnosing the disease of pellagra previous to its development. This competition closes on June 30, 1906.

A PETITION has been presented to His Majesty in Council asking for the grant of a charter of incorporation to the South African Philosophical Society under the name of "The Royal Society of South Africa."

MR. WILFRED MARK WEBB has accepted the honorary secretaryship of the Selborne Society.

THE death is announced of Dr. Tillaux, professor of surgery in the University of Paris, president of the Academy of Medicine, and Grand Officer of the Legion of Honour.